

What is Claimed is

1. A multi-functional actuator comprising:
a housing having an internal space and a groove in the inner side;
5 a sound-generating diaphragm with an outer end fixed to the upper end of said housing;
 a voice coil fixed to the bottom of said diaphragm;
 a vertically magnetized magnet;
 an upper plate attached to said magnet for forming a magnet
10 circuit;
 a yoke for forming the magnetic circuit together with said magnet;
 a weight for defining a vibration body together with said yoke;
15 a leaf spring fixed into said grooves of the housing and having a portion of curvature; and
 a vibrating coil installed in said housing for generating vibration using a magnetic flux formed in a magnetic system.

- 20 2. The multi-functional actuator according to claim 1, wherein said leaf spring is provided in a pair, and at least one of said springs has the portion of curvature.

- 25 3. The multi-functional actuator according to claim 1, wherein said leaf spring is provided as one.

4. The multi-functional actuator according to claim 1,
wherein said portion of curvature of the leaf spring is in
elastic portions.

5 5. The multi-functional actuator according to claim 1,
wherein said portion of curvature of the leaf spring is in the
circumferential direction.

6. The multi-functional actuator according to claim 1,
10 wherein said portion of curvature of the leaf spring is provided
in plural number.

7. The multi-functional actuator according to claim 1,
wherein said portion of curvature of the leaf spring is a bending
15 portion.

8. The multi-functional actuator according to claim 1,
wherein said portion of curvature of the leaf spring is a
twisting portion.

20

9. The multi-functional actuator according to claim 7,
wherein said bending portion of the leaf spring is waved.

10. The multi-functional actuator according to claim 7,
25 wherein said bending portion of the leaf spring is sharp shaped.

SEARCHED
INDEXED
MAILED

11. The multi-functional actuator according to claim 7,
wherein said bending portion of the leaf spring is radially bent
in an outer circumferential portion of said leaf spring, and
smoothly shaped at the bending portion and the adjacent right
5 and left ends.

12. The multi-functional actuator according to claim 7,
wherein said bending portion of the leaf spring is radially bent
in an outer circumferential portion of said leaf spring, and
10 linearly shaped at the bending portion and the adjacent right
and left ends.

13. A multi-functional actuator comprising:
a housing having an internal space in the inner side;
15 a coil installed in said housing;
a magnet;
a yoke for forming the magnetic circuit together with said
magnet; and
at least one leaf spring fixed in the housing and having a
20 portion of curvature.

14. The multi-functional actuator according to claim 13,
wherein said portion of curvature of the leaf spring is in
elastic portions.

15. The multi-functional actuator according to claim 13,
wherein said portion of curvature of the leaf spring is in the
circumferential direction.

5 16. The multi-functional actuator according to claim 13,
wherein said portion of curvature of the leaf spring is a bending
portion.

10 17. The multi-functional actuator according to claim 13,
wherein said portion of curvature of the leaf spring is a
twisting portion.

15 18. The multi-functional actuator according to claim 16,
wherein said bending portion of the leaf spring is waved.

19. The multi-functional actuator according to claim 16,
wherein said bending portion of the leaf spring is sharp shaped.

20 20. The multi-functional actuator according to claim 16,
wherein said bending portion of the leaf spring is radially bent
in an outer circumferential portion of said leaf spring, and
smoothly shaped at the bending portion and the adjacent right
and left ends.

25 21. The multi-functional actuator according to claim 16,

wherein said bending portion of the leaf spring is radially bent in an outer circumferential portion of said leaf spring, and linearly shaped at the bending portion and the adjacent right and left ends.

5

22. A multi-functional actuator comprising:

a housing having an internal space in the inner side;

a sound-generating diaphragm with an outer end fixed to the upper end of said housing;

10 a coil fixed to the bottom of said diaphragm;

a magnet;

a yoke for forming the magnetic circuit together with said magnet; and

15 at least one leaf spring fixed in the housing and having a portion of curvature.

23. The multi-functional actuator according to claim 22, wherein said portion of curvature of the leaf spring is in elastic portions.

20

24. The multi-functional actuator according to claim 22, wherein said portion of curvature of the leaf spring is in the circumferential direction.

25 25. The multi-functional actuator according to claim 22,

wherein said portion of curvature of the leaf spring is a bending portion.

26. The multi-functional actuator according to claim 22,
5 wherein said portion of curvature of the leaf spring is a twisting portion.

27. The multi-functional actuator according to claim 25,
wherein said bending portion of the leaf spring is waved.

10
28. The multi-functional actuator according to claim 25,
wherein said bending portion of the leaf spring is sharp shaped.

15
29. The multi-functional actuator according to claim 25,
wherein said bending portion of the leaf spring is radially bent
in an outer circumferential portion of said leaf spring, and
smoothly shaped at the bending portion and the adjacent right
and left ends.

20
30. The multi-functional actuator according to claim 25,
wherein said bending portion of the leaf spring is radially bent
in an outer circumferential portion of said leaf spring, and
linearly shaped at the bending portion and the adjacent right
and left ends.